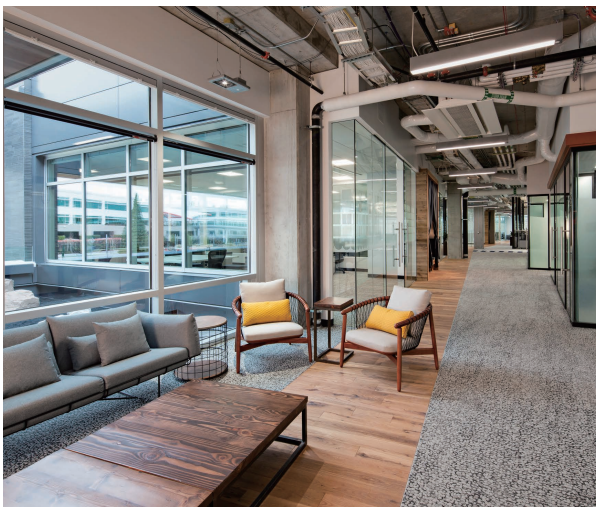
Sharing Global Best Practices Sustainable Communities

分享全球最佳实践 可持续发展社区



Urban Land Institute

ULI Foundation

Urban Land Institute
Asia Pacific 亞太區

www.uli.org

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本报告由城市土地学会基金会（ULI Foundation）与以下单位共同提供支持：

We would like to thank Architecture 2030 and GBPP for their contributions to this report. ULI, Architecture 2030 and GBPP co-organized the “Sharing Global Best Practices – Sustainable Communities” forum on June 14, 2016 in Shanghai. The articles in the report are written by experts who delivered presentations in the forum.

感谢建筑2030与绿色建筑专业人员联盟对本报告的贡献。城市土地学会、建筑2030以及绿色建筑专业人员联盟于2016年6月14日在上海共同举办了“分享全球最佳实践——可持续发展社区”论坛。本报告中各篇文章均出自参与上述论坛并发表演讲的专家。

About Architecture 2030

Architecture 2030 is a non-profit organization established in 2002. Architecture 2030’s mission is to rapidly transform the built environment from the major contributor of greenhouse gas (GHG) emissions to a central part of the solution to the climate and energy crisis.

关于建筑 2030

建筑2030是一家成立于2002年的非牟利机构。建筑2030旨在快速将建筑环境从温室气体主要来源的角色转化为解决环境能源危机的核心力量。

About GBPP

Green Building Professional Partnership (GBPP) - Creating, Fostering, and Promoting a platform to create more opportunities for successes for all green building professionals in China.

关于绿色建筑专业人员联盟

绿色建筑专业人员联盟(GBPP)－绿色建筑专业人员的共同平台。创造、培养、推动绿色建筑从业人员的更多成功机会。

About the Urban Land Institute

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI is committed to

• Bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs;

• Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem solving;

• Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development;

• Advancing land use policies and design practices that respect the uniqueness of both the built and natural environments;

• Sharing knowledge through education, applied research, publishing, and electronic media;

• Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

Established in 1936, the Institute today has over 40,000 members worldwide, representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

关于城市土地学会

城市土地学会(ULI)的宗旨是在负责任的土地使用的议题上担当领导角色，并促进全球活力社区的建立和持续发展。ULI 致力于：

• 汇聚房地产业及土地使用领域内的领袖人士，搭建交流平台，提供最佳范例及为社会服务；
• 透过师友指导，讨论及从解决问题中促进ULI的会员与非会员的合作；
• 探索城市化、保育、再生、土地使用、资本形成和可持续发展等问题；
• 推动土地使用政策及设计实践，以维持建筑及自然环境的独特性；
• 为政府在土地利用、再开发等方面遇到的棘手问题提供综合实用的解决方案；
• 通过教育、应用研究、刊物出版及电子媒体传播专业知识维系一个多样化的本地实践及咨询服务项目的全球网络，以应对当前和未来的挑战。

自从1936年成立以来，学会目前在全球拥有超过40,000名会员，囊括了各国及国际房地产行业领导者和决策者，分别代表着公、私营土地使用及房地产发展的各个领域。通过最权威的多学科参与的不动产论坛，ULI致力于为地方、国内及国际行业领导者与决策人提供交流思想、信息和经验的开放式平台，打造更加美好的城市场所。

About ULI Foundation

The ULI Foundation is the philanthropic partner of the Urban Land Institute, providing an assured source of funding for ULI's core research, education, and public service activities. Through its various giving programs, the Foundation helps strengthen ULI's ability to provide leadership in the responsible use of land to enhance the total environment.

关于城市土地学会基金会

城市土地学会基金会是城市土地学会的慈善合作伙伴，保证了城市土地学会的核心研究、教育和公共服务活动的资金来源。基金会通过各种资金支持计划，帮助增强了城市土地学会通过在负责任的土地使用上担当领导角色来改善整体环境的能力。

Foreword

The “Sharing Global Best Practices – Sustainable Communities” by ULI China Mainland was initially funded by ULI Foundation’s Urban Innovation Grant awarded in October, 2014. Subsequently, the project received further support from ULI member companies and ULI members based in Shanghai as well as Architecture 2030 and Green Building Professional Partnership (GBPP).

Based on the recommendations of the first workshop conducted with Shanghai-based ULI members, ULI China Mainland produced case study reports on 1) increasing urban density – Arlington, Virginia, U.S., 2) ULI Greenprint Center, and 3) ULI Reality Check. These reports produced in the fall of 2015 in English and Chinese were distributed in various ULI and real estate industry events and also served as key reference materials in ULI events, most notably in product council meetings in December, 2015 as part of the ULI China Mainland Winter Meeting held in Shanghai in December, 2015.

In addition, the project culminated in a half-day seminar in Shanghai on June 14, 2016. The articles included in this report were submitted by the speakers in the seminar. The seminar was jointly organized by ULI Chinese Mainland, Architecture 2030, and GBPP. It is intended that the report will be distributed in future events organized and/or participated by any of the co-organizers and serve as an important reference material in such events.

前言

2014年10月，城市土地学会(ULI)中国大陆获得了由ULI基金会授予的城市创新基金。“分享全球最佳实践——可持续发展社区”系列报告最先由上述城市创新基金提供资金支持。随后，本项目获得来自上海的ULI企业与个人会员，以及建筑2030和绿色建筑专业人员联盟的支持。

在上海举行的第一个工作坊上，ULI会员给出了很多建议，基于这些建议，ULI中国大陆陆续出版了以下案例研究报告：1）优化用地——美国弗吉尼亚州阿灵顿县；2）城市土地学会绿色印迹中心案例研究；以及3）城市土地学会可持续发展案例研究——现状核实。这些报告已于2015年秋季以中英文版本在多个ULI活动以及房地产行业会议上发行。报告在ULI活动中作为重要参考资料出现，报告还被应用于2015年12月在上海举办的城市土地学会中国大陆冬季会议的专家研讨会上。

此外，本项目还于2016年6月14日在上海举行了为期半日的研讨会。本报告中的文章均出自参与上述研讨会并演讲的专家。本研讨会由城市土地学会中国大陆、建筑2030以及绿色建筑专业人员联盟共同举办。本报告将于上述举办方未来组织或参与的活动上发行，作为这些活动的一份重要参考资料。

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Portland's Urban Design Approach: Low Carbon, High Livability

波特兰城市设计方法：低碳高宜居性

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查尔斯·凯利是一名ZGF建筑事务所的建筑师

城市设计师。该公司位于俄勒冈州波特兰市。

Portland is known for incubating public-private partnerships, urban sustainability, and a new approach to urban design through EcoDistricts. These innovations emerged over the last 50 years as the City of Portland and its community worked together to improve Portland's water and air quality and reduce its carbon emissions through low-cost, pragmatic design solutions. As a result, Portland's employment opportunities have also grown as the City continues to attract creative class industries that are drawn to Portland's unique urban form and desirable livability.

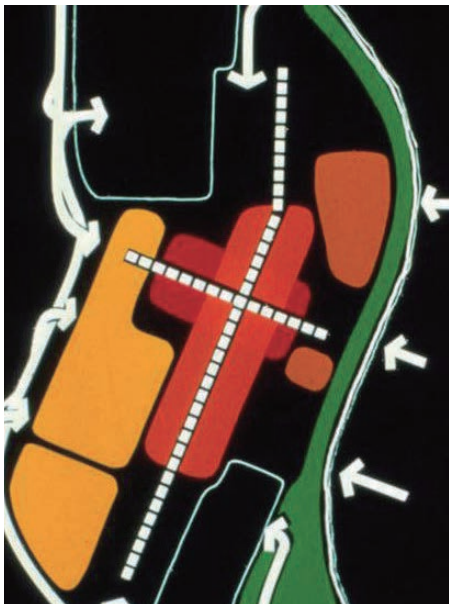
波特兰因其在培育公私合作关系、城市可持续发展、以及新型生态区城区设计方面的成就而为众所周知。过去50年里，在这座城市和社区共同提出并致力的创新方法改善了波特兰的水质和空气质量，碳排放量减少，同时采用了低成本的实用设计方案。就业机会因此得到增长。波特兰以其独特的城市形态和宜居性，持续吸引着创意类产业的加入。

In the early 1970s, the City of Portland was out of compliance with federal standards for both water and air quality; and in 1972, the City adopted a new a Central City Plan that fundamentally changed the configuration of Portland. This new configuration had less demand for cars, and the City invested in light rail and streetcar instead of freeways. Portland replaced unnecessary streets, including the significant transformation of Harbor Drive into Portland's 73-acre Waterfront Park.

1970年代早期，波特兰市的水质和空气质量均不符合联邦标准；1972年该市采用了配有新环保政策的新型中心城市计划，从根本上改变了波特兰的城市结构。这种新的城市结构对单乘客车辆的需求更少了。更少的车意味着城市也可随之放弃建造更多高速公路，转而进行轻轨和电车投资。社区替代了不必要的街道，例如将一条港湾大道改造为一个占地面积为73英亩（443亩）的滨水公园。

The remaining streets developed vitality and activity with strategic street improvements for transit access and bike mobility, and with green infrastructure to clean urban storm water runoff. Combined with the incorporation of active ground-floor spaces in buildings, Portland's streets became a desirable public realm connecting neighborhoods across the city. The 1990s development of the Pearl District, and specifically Hoyt Street Yards, proved the value in developing housing downtown, near jobs, and in strengthening the public realm for people walking, biking, and using transit.

其余街道在公共交通和自行车出行方面进行了具有长远意义的改进，以提升街道活和增加街道活动，并建造了清洁雨水径流的绿色基础设施。通过与建筑地面层活动空间的完美结合，城市街道已成为连接各个社区的理想公共区域。20世纪90年代珍珠区的开发，特别是霍伊特街的发展，证明了发展工作地点附近城区住房的重要性，及其对加强公共领域发展，改善人们步行、骑车和乘坐公共交通工具的价值。



In 1972,Portland adopted a new Central City Plan and environmental policies that changed its configuration.
1972年，该市采取了一项新的中心城市计划和政策，试图创建一种新型城市结构。

Portland's multimodal transportation improvements in the1990s proved the value in creating housing near jobs, and in strengthening the public realm.
波特兰在上世纪90年代的多样交通模式改进措施证明了在工作地点附近设置住宅的重要性及其对公共空间的强化作用。

Waterfront Park, 1978
滨水公园，1978年

Pearl District, 1994
珍珠区，1994年

Transit Mall, 1977
公交步行街扩建，1977年

In 1970,Portland was known for its poor water, air quality and downtown vitality.
20世纪70年代，波特兰因其水质、空气质量较差，城市活力不足而为世人所知。

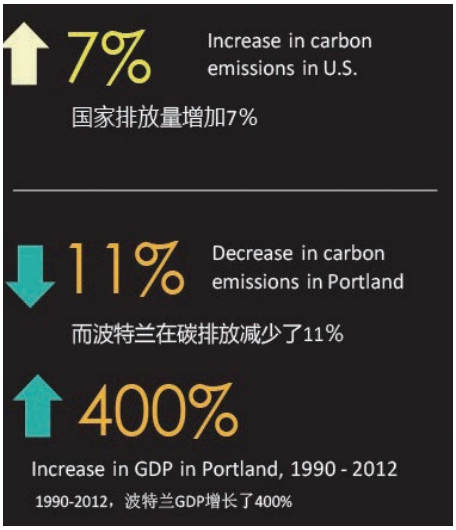
In 1993, Portland became the first city in the United States to create a local climate action plan for cutting carbon. The community recognized how the City could be shaped to overcome negative urban impacts to air and water quality by collectively reducing the use of fossil fuels.

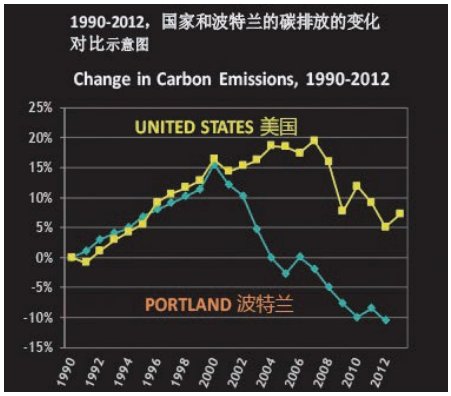
1993年，波特兰成为美国首个制定“减碳排放”本地气候行动计划的城市。社会大众意识到可以通过集体行动减少化石燃料的使用，塑造城市形象，克服其对城市空气和水造成的不利影响。

Inspired, the City took urban sustainability a step further. Open space systems and buildings were refined to connect the outdoor and indoor spaces of workplaces and living places across districts to create low-energy Eco Districts. As these EcoDistrict communities integrated the outdoors into their lifestyles, they used buildings less and their district's energy use and carbon emissions went down. As residents walked or biked between their home and workplace, the City's fossil fuel consumption also went down. In Portland, this has cut carbon emissions by 11% and increased the local economy by 400%.

受此启发，该市进一步推进了城市可持续发展计划。通过改善开放空间系统和建筑设施，创建了连接室外和室内工作生活区的纽带以及低能耗生态区。由于这些生态社区住户已将户外活动纳入了他们的生活方式，因此他们更少的使用建筑，并使得社区的能耗和碳排放下降。居民通过步行或骑车方式往返于家和工作地，其使用的化石燃料也变得更少。在波特兰，碳排放量减少了11%，经济增长翻了两番。

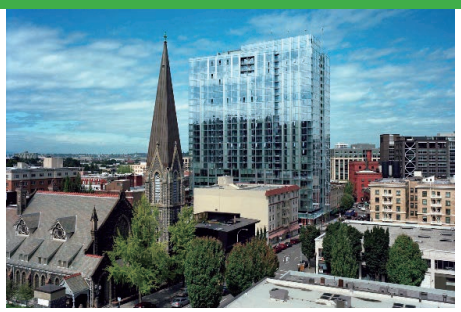
City of Portland policies shaped a city with 11% less carbon and 400% more GDP.
波特兰市政府政策使其碳排放减少11%，经济增长翻两番。





When the public realm expands the outdoor activities of live places and workplaces, buildings use less energy and make healthy, resource-efficient neighborhoods.
当公共空间扩展了生活和工作的室外活动，建筑耗能随之减少。资源效率更高，更健康的社区形成了。

Director Park, 2009
迪雷克托公园，2009 年



Twelve | West, 2009
(2030 Architecture Plan Compliant)
西12大楼，2009年（符合2030建筑节能目标）

Transit Mall Renovation, 2009
公共交通车站更新，2009年

Matthew Combe
Program and Operations Director
Seattle 2030 District

马修·库姆
西雅图2030城区计划的项目运营总监

Seattle 2030 District
Private-Public Partnership that works
西雅图 2030 城区计划：卓有成效的公私合作

The City of Seattle is growing and is expected to add 70,000 housing units and 115,000 jobs by 2035. This growth is putting significant stress on the aging transportation infrastructure and the availability of low-income housing. We at the Seattle 2030 District are motivated to ensure new office and multifamily buildings are high-performing and to increase the efficiency of existing buildings that help promote affordabilty.

The Seattle 2030 District is one of 13 districts (and more are emerging) that have committed to reducing building energy use, water consumption and transport emissions via a private-public partnership comprising of property owners and manager, services stakeholders and community stakeholders.

西雅图市的城市发展速度非常快，预计到2035年，西雅图将新增7万个住宅单元，以及11.5万个工作岗位。这样的增长速度对已经老旧不堪的交通基础设施，以及保障性住房的供应量都带来不小的压力。我们的西雅图2030城区计划的宗旨是确保新建办公楼和多户住宅的节能高效，同时提高原有建筑的效率，这也有助于提高消费者的负担能力。
西雅图2030城区是13个（将有更多区域加入进来）承诺减少建筑能源和水资源消耗、减少交通工具排放的区域之一。这是一个由房地产业主、房地产物业管理公司，服务商股东，以及社区相关利益方组成的公私合作组织。

Our work supports the City of Seattle's 2013 Climate Action Plan, King County's 2015 Strategic Climate Action Plan, and other local priorities. At the national and international levels, we are contributing to the creation of a 2030 Districts Network which will create collaborative opportunities beyond the established and emerging Districts in North America.

As a membership organization, the Seattle 2030 District plays a unique role in Seattle's built environment by:

我们已经支持了西雅图市2013年气候行动计划、金县2015战略气候行动计划，以及其它当地的重要活动。我们也为建立2030城区计划的全国和国际网络作出了贡献。2030城区计划网络致力于在北美为原有和新加入的承诺区域以及其他组织创造更多的合作机会。
作为一个会员制组织，西雅图2030城区计划在本市的建筑环境改善中发挥了特殊的作用：

CONVENING
召集作用

- Bringing together leaders at roundtable meetings, product demonstrations, educational sessions and other events.
- Pooling resources on projects to help building and property owner collaborate on solutions.

- 召集各类组织的领导人齐聚一堂，进行产品演示，召开研讨会，举办各类其它活动。
- 集中不同项目的资源，帮助建筑和地产业主互通有无，共同寻找解决方案。

OUR GOALS 我们的目标

	ENERGY 能源	WATER 水资源	TRANSPORTATION 交通运输
	Increase Seattle's capacity for future growth and development by advancing energy efficiency. 通过提高能源效率增加西雅图未来发展能力	Conserve Seattle's potable water resources and protect Puget Sound through effective management of polluted runoff. 通过有效管理污染径流保护西雅图的饮用水资源和普吉海湾。	Promote efficient, affordable, and low-carbon transportation options. 发展高效、廉价、低碳的交通运输方式。
EXISTING BUILDINGS 原有建筑	 到2030年减少能源消耗50%	 到2030年减少水资源消耗50%	 到2030年减少交通工具排放50%
NEW CONSTRUCTION 新建筑	即刻减少能源消耗70%	即刻减少水资源消耗50%	即刻减少交通工具排放50%

DEMONSTRATING
示范作用

• Testing out new technologies and approaches to aid members in improving building performance.

• Serving as a model for collaboration and progress across multiple building types within a geographic area.

• 进行新技术、新方法的测试，帮助会员提高建筑的节能效率。

• 成为促进区域内跨物业类型合作和发展模式的示范。

ADVOCATING
倡导作用

• Presenting a united position on policy issues that affect the operating environment.

• 对于影响到运营环境的政策问题，我们能够表达一个一致的立场。

EDUCATING
教育作用

• Facilitating information and networking sessions oriented to peers in Seattle.

• Gaining access to regulators and government program staff to engage on policy matters.

• 我们能够召集西雅图行业同业在一起共同协商，召开旨在促进信息交流，加强彼此联系的会议。

• 我们有能力联络立法者和政府机构人员，影响政策制定。

FACILITATING
促进作用

• Identifying barriers and working with others to make changes in the operating environment (market, political, environmental, financial etc.)

• 寻找问题和困难所在，并与各方协作共同改变运营环境（包括市场因素、政治因素、环境因素，以及财政因素等）。

CELEBRATING
鼓励作用

• Awarding programs for exemplary buildings, owners, developers, and stakeholders to build upon our successes.

• 为优秀建筑、业主、开发商以及利益相关者设立奖项，为我们的成功锦上添花。

As of June 2015, the Seattle 2030 District has achieved the following:

截至2015年6月，西雅图2030城区计划已经取得了以下成就：

242 — Total Number of Member Buildings
会员建筑总数

47,861,797 — Total sq. ft. of Member Buildings
会员建筑总面积（平方英尺）

22.2% — Average Electricity Use Decrease
电耗平均下降

3.4% — Average Water Use Decrease
水耗平均下降

6.3% — Average CO_2 Decrease Due to Alternative Transportation
由于采用了替代性交通方式，二氧化碳排放平均下降

Dr. Henry Tsang

Registered Architect and Assistant Professor at Keimyung University Department of Architectural Engineering (South Korea)

曾庆业博士

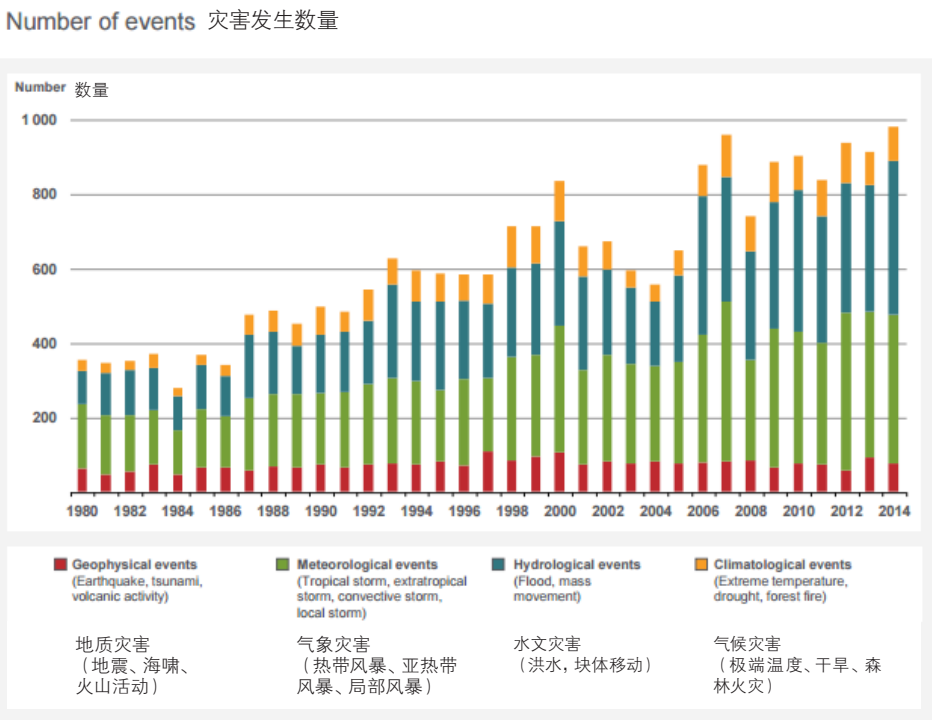
注册建筑师，韩国启明大学建筑工程系助理教授

*本调查得到了韩国启明大学BISA科研补助金的资助（2016）。

Design for Resilience and Sustainability in Asia

亚洲的灾后恢复和可持续发展设计理念

Fig 1. Loss events worldwide 1980-2014 (Source: Munich RE)
图1，1998年至2014年全球灾害事件（数据来源：慕尼黑再保险公司）



Natural disasters are becoming more frequent all around the world. According to data from Munich Re, occurrences of natural disasters have tripled in the last 30 years, in the form of meteorological (storms), hydrological (floods) and climatological (droughts) events. The only type of disaster that has remained steady is geophysical events, such as earthquakes and tsunamis. This suggests that there is in fact a direct relationship between climate change and the growing occurrences of natural disasters.

世界各地自然灾害的发生越来越频繁。慕尼黑再保险公司的数据显示，近30年来，自然灾害的发生增加了两倍。灾害的主要表现是以风暴形式出现的气象灾害、以洪水形式出现的水文灾害，以及以干旱形式出现的气候灾害。然而，有一种形式的灾害，其出现的频率一直保持稳定，那就是地质灾害，如，地震、海啸等。这表明，气候变化与自然灾害频发之间有着直接的联系已是事实。

As a general term, a disaster is defined as a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. In other words, a disaster is when the impact of the event is greater than our capacity to cope with the event. That being said, this means that it includes not only natural disasters, but also man-made disasters, such as wars and terrorism.

灾害作为一个通用术语，指的是严重破坏和扰乱一个社区，乃至整个社会功能的发挥，涉及广泛的人员、物料、经济或环境的损失和影响，其严重程度超出了社区或社会凭借自身资源处理的能力范围。换言之，就是灾害事件的严重程度大于我们的处理能力。也就是说，灾害不仅包括自然灾害，也包括人为的灾难，如，战争和恐怖主义等。

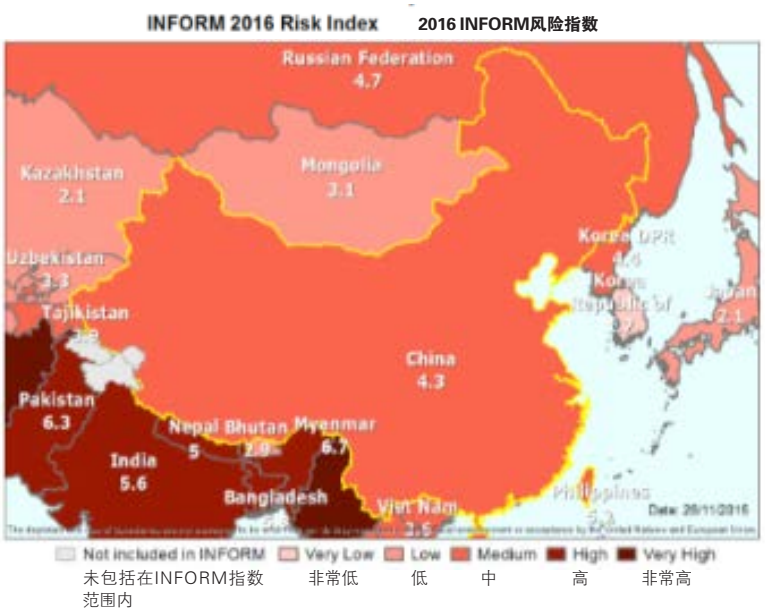
Further, disasters are seen as the consequence of inappropriately managed risk. These risks are the product of a combination of both hazards and vulnerability. Hazards that strike in areas with low vulnerability will never become disasters, as is the case in uninhabited regions. Consequently, developing countries suffer the greatest costs when a disaster hits, as more than 95% of all deaths caused by hazards occur in developing countries, and losses due to natural hazards are 20 times greater in developing countries than in industrialized countries.

此外，灾难也被认为是因风险管理不当而造成的后果。这些风险是危害因素以及灾害承受能力双重作用的结果。当危害因素出现在低损害后果的地区从来不会造成灾害，比如，灾害事件发生在无人区。因此，发展中国家遇到灾害时，所受的损失最大——灾害造成的死亡数量有95%以上发生在发展中国家，同时灾害在发展中国家造成的损失也是工业化国家的20倍。

Fig 2. China's INFORM Value (Source: INFORM)
图2. 中国国家风险管理指数（数据来源：INFORM）

Eastern Asia 东亚
Upper middle income 中高收入

	Value 指数值	Rank 风险值	Trend 趋势
INFORM	4.2	62	–
Hazard（危害因素）	6.9	15	–
Vulnerability （承受能力）	2.7	109	▼
Coping Capacity（灾害处理能力）	4.1	122	–



INFORM Risk Index
国家风险管理指数（INFORM）

The INFORM Risk Index is a comprehensive tool that offers global, open-source risk assessment to assist humanitarian crisis and disasters. Containing risk data for over 190 countries, information it provides can help better evaluate the dangers of the situation when planning for prevention, preparedness and response projects.

国家风险管理指数（INFORM）是一个综合性工具，提供的是全世界开放源风险评估，目的在于帮助190多个国家进行人道危机和灾难的风险评估。INFORM所提供的信息有助于在制定灾害预防、灾后重建以及救援措施时，更好地估计危害程度。

China's INFORM index is evaluated at 4.2, and ranked 62nd in the world, which would be considered as medium risk. The data indicates that China has a relatively high risk of hazards with a value of 6.9/10 and 15th in the world, particularly frequent are earthquakes, tsunamis, cyclones and floods. The index also shows potential of conflict risk, which indicates a possibility of man-made disasters. The index also analyzes the country's Vulnerability, indicating potential human casualties and financial strength, and Coping Capacity, which is an indicator of the infrastructure and support system.

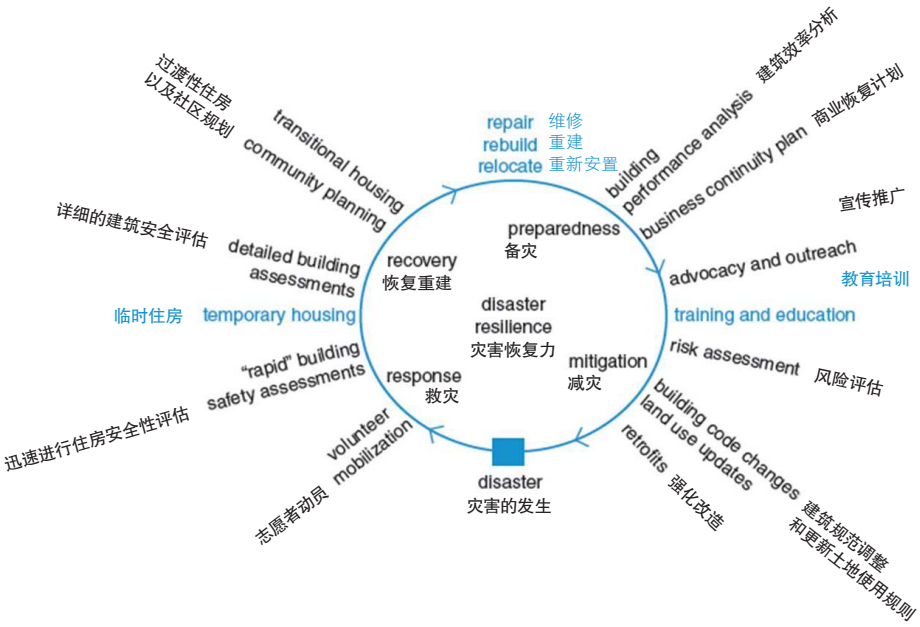
中国的国家风险管理指数为4.2，在全球排名第62位，可以视为中等风险。从数据上来看，中国的危害因素指标相对较高，为6.9/10，在全球排名15位。地震、海啸、龙卷风和洪水的发生尤其频繁。该指数还显示出潜在的冲突风险，表明可能存在人为灾害。指数还分析了中国的风险承受力，这个数据表明潜在的人员伤亡和财政能力，以及灾害的处理能力，这是衡量一个国家的基础设施和援助体系的指标。

Designing Disaster Resilience
灾后恢复力模型

Disaster Resilience is the ability of individuals, communities, organisations and countries to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development. With regards to reconstruction efforts, a model of disaster resilience was proposed by the American Institute of Architects that outlined the following four phases of the Disaster Resilience Cycle: 1. Response, 2.Recovery, 3.Preparedness, 4. Mitigation.

灾后恢复力是指个人、社区、组织以及国家遭受灾害、冲击或压力后，在不以牺牲长期发展为代价前提下的适应和复元能力。考虑到灾后重建的需求，美国建筑师学会提出了一个灾后恢复力模型。这个模型大致描述了灾后恢复的周期性循环，包括了四个阶段：1.救灾；2.恢复重建；3.备灾；4.减灾

Fig 3. Disaster Resilience Cycle (Source: American Institute of Architects)
图3. 灾后恢复周期循环图（数据来源：美国建筑师学会）



1. Response: This phase starts immediately from the disaster and includes efforts to salvage and control damage following the impact. This comprises of volunteer mobilization and rapid building safety assessment to identity possible hazards from damaged and unstable structures.

救灾：这个阶段要在灾害发生之时就立即展开，既要竭尽全力实施救援，也要控制灾害所造成的损失。这个阶段的行动包括志愿者的动员，以及迅速进行建筑安全性的评估，发现受损以及不稳固建筑的危险因素。

2. Recovery: This phase indicates that basic infrastructure has been reestablished and people can move from shelters to temporary housing. The reconstruction efforts start from performing detailed building assessments to identify the structures that can be reused. Next step is to involve the inhabitants in the community planning. As the functions of the city start to recover, some of the inhabitants can move back home or more permanent housing.

恢复重建：在这一阶段，基本的基础设施已经恢复，受灾人员可以从避难所转入临时住房。灾后重建的准备工作开始于对建筑进行详细的性能评估，判断哪些建筑结构可以重复利用。紧接着是让社区居民参与社区规划。随着城市职能开始恢复，部分居民可以返回家园，或搬进更为永久性的住房居住。

3. Preparedness: This phase initiates the actual repair, rebuild and relocate process. With new construction, stronger and better buildings can be achieved through building performance analysis. A business continuity plan is put into place for the sustainable development of the community. Advocacy and outreach campaigns to establish the network of people and organizations that can contribute to the rebuild.

备灾：这个阶段开始了实质性的灾后重建流程：维修、重建以及重新安置。通过对建筑性能进行分析建造新的建筑结构，使新的建筑更结实，性能更佳。制定商业恢复计划，使社区取得可持续发展。进行宣传和推广活动，建立能够为重建做出贡献的个人和组织网络。

4. Mitigation: This phase drafts the plan of action in the event of recurring disasters through training and education. Risk assessment, such as the INFORM Index, will provide the information necessary to evaluate the local conditions. Building code changes and land use updates will provide the minimum safety rules and guidelines for future buildings. And retrofits are performed to strengthen the existing buildings.

减灾：在这个阶段，需要通过培训和教育制定避免灾害再次发生的行动计划。风险评估数据，如INFORM指数，能够提供用来评估当地情况的必要信息。对建筑规范的调整以及最新的土地使用规则将为未来的建筑提供基本的安全规范和指导。最后，还将对原有建筑进行强化改造。

Organizations working in disaster reconstruction are numerous ranging from the United Nations, governments, and NGOs. Specific to buildings, Architecture Without Borders International (Architectes Sans Frontières International) is a network of organizations that coordinates relief and reconstruction projects linking global and local architects. Otherwise, the Rockefeller Foundation established the 100 Resilient Cities worldwide network to share each other's technical skills and organizational structures.

致力于灾后重建的组织机构不计其数，从联合国机构，到政府机构，以及非政府组织。具体到建筑行业，协调救灾和重建项目的全球性组织网络是国际无国界建筑师联合会。这是一个能够联系全球和本地建筑师的国际性组织机构。另外，洛克菲勒基金会建立了一个包含了100个灾后重建城市的全球性网络，以此来分享他们的专业技术和组织建筑。

Case Study: The University of Indonesia Project

Indonesia is a country located on the Pacific Ring of Fire, an area of constant tectonic activity, and where natural disasters are frequent. In 2004, Aceh was struck by a historic earthquake and tsunami killing over 170,000 people. In 2007, the Indonesian government collaborated with the Japanese Government to develop a prototype for sustainable resilient buildings. Coordinated by the Japan International Cooperation Agency (JICA), Japanese architects from the firm Nihon Sekkei and consultants from UNICO International Corporation designed and constructed a green and earthquake-resistant hospital and health faculty building, located in Depok City within the University of Indonesia campus. Japanese architects, engineers and equipment specialists worked closely with local Indonesian professionals and authorities to realise this project. This project is an example of international collaboration in the design for disaster resilience and sustainability in Asia.

案例研究：印度尼西亚大学项目

印度尼西亚是一个处于环太平洋火山带上的国家。该地区地壳构造活动不断，自然灾害频繁。2004年，亚齐遭到史无前例的地震和海啸袭击，造成17万人死亡的悲剧。2007年，印尼政府和日本政府合作开发并建设了可持续发展抗震建筑原型。在日本国际合作署（JICA）的协调下，日本的日建设计公司建筑师以及来自日本UNICO国际公司的咨询顾问设计并建造了一座绿色抗震的医院和健康学院大楼，位于西爪哇德波市的印度尼西亚大学校园内。日本的建筑师、工程师以及设备专家与印尼当地的教授以及主管机构通力合作，最终实现了这个项目。这个项目已经成为亚洲灾后恢复力和可持续发展建筑设计国际合作项目的样板。

Fig.4 The University of Indonesia (Source: Nihon Sekkei)
图4. 印度尼西亚大学（图片来源：日建设计公司）

Fig.5 The Design Team: Japanese and Indonesian consultants. (Source: Henry Tsang)
图5. 设计团队：日本和印尼咨询顾问。（图片来源：Henry Tsang）

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Dragon River Technological Incubation Park Landscape Renovation: Rainwater Recycling in a Community

龙河科技成果孵化园景观改造：雨水管理的社区实践

Langfang, a typical northern city in China, is an arid city experiencing a serious shortage of water resources. The amount of long term average surface water resources of the city is 2,556.9 billion cubic meters, and the amount of surface water resources per capita is about 28.6% for the province, and 2.8% for the whole country. Due to the scarcity of surface water resources, industrial and domestic water usage of the area needs to be addressed by over-exploiting groundwater resources. In practice, on the one hand, long term groundwater exploitation has caused continuous decline of the urban groundwater level, and the maximum groundwater depth is 75 meters, which is 40 meters more than that in the 1980's. On the other hand, urban rainwater is drained off through the urban rainwater discharge system, causing a huge waste of resources.

廊坊，是一个典型的北方城市，也是一个干旱少雨、水资源严重缺乏的城市。城市多年平均地表水资源量为25569亿立方，人均地表水资源占有量是全省的28.6%，全国的2.8%。地表水资源的匮乏使得该地区不得不以超采地下水作为解决该区工业生活用水的唯一途径。在现实中，一方面长期开采地下水造成城市地下水位持续下降，地下水位埋深最大在75米以上，比80年代增加了40米。另一方面，城市雨水通过城市雨水管网排走，造成巨大的资源浪费。

At the request of the owner, we were asked to conduct a landscape reformation and upgrading for Langfang Longhe Scientific and Technological Achievements Incubation Garden. In the new plan, the original factory was to be transformed into a new Maker's Base. We believed that the ability of an innovative community to assume more social responsibility at a greater level while creating an open and shared dynamic space depends on the concept of urban sustainability that starts from small community unit and achieves the rainwater recycling.

应业主之邀，我们将对位于廊坊市龙河科技成果孵化园进行景观改造和升级。在新的计划中，原来的厂区将被改造成为一个全新的创客基地。我们认为：一个创新社区，在创造开放共享的活力空间的同时能否在更大的层面承担更多的社会责任，基于城市可持续发展的理念，从一个社区单元出发，实现雨水资源的循环利用。

We encountered many challenges in the implementation of the whole project:

Challenge I, the owner had no idea about rainwater management. We had to persuade them to regard rainwater management as main expression of the project.

Challenge II, the owner wanted to represent a bright and beautiful community image through the project, and there was a very tight schedule – less than 2 months –from design to construction completion.

Challenge III, both the project cost and construction technology were very limited.

在整个项目的实施过程中，面临了诸多的挑战：
挑战一：业主对雨水管理没有任何概念，我们需要说服他把雨水管理作为设计最主要的表现；
挑战二：业主需要通过这个项目展现一个光鲜美丽的社区形象，给予从设计到施工完成的时间只有不到两个月；
挑战三：项目成本和建造技术极端受限制。

With the above challenges, we adopted a different strategy for rainwater management for this project from that of other projects we managed in the past. A technically simple rainwater management strategy with easy construction and low cost was designed, convincing our client that rainwater management would not increase project investment or construction difficulty while being completed within the scheduled timeframe.

基于以上挑战，这个项目雨水管理与过去我们在其他项目采取策略不同，我们采取一种技术简单易行、施工方便、成本低廉的雨水管理策略，来告诉我们的客户，采用雨水管理作为项目的最主要的表达，并不增加项目投资，也不带来施工难度增加，同时也可以在计划的时间内完成。

Firstly, to define the rainwater collecting area within the site, after a site analysis, we used the roof area and site area of six factory buildings within the site, a total of 12,475 square meters, as the rainwater collecting area of the whole

community.

首先，我们在划定场地内的雨水收集区。经过场地分析，我们把场地内六栋厂房的屋顶区域和场地面积区域，共计12475平米，作为整个社区的雨水收集区域。

Secondly, a road running through the site was designed as a rainwater catchment zone. The road was built with permeable concrete for effective rainwater seepage. At the same time, a shallow ditch was also built along one side of the road, serving as a rainwater catchment ditch for the whole community.

其次，在场地中设计一条贯穿场地的道路作为雨水汇水带。道路以透水混凝土为材料，可以有效的进行雨水下渗，同时在道路一侧建造一条浅沟，作为整个社区的雨水汇水沟。

Thirdly, two rainwater seepage areas were formed in two different areas on site: a sunken green seepage area and a rainwater garden seepage area.

第三，在场地内不同区域形成两个雨水下渗区：一个下凹绿地下渗区、一个雨水花园下渗区。

By building the rainwater management system, rainwater falling onto building roofs and the site during rainy season converges into the catchment zone, eventually entering the rainwater seepage area for storage and seepage. In the first rainy season after the construction is completed, nearly 100% of the rainwater of nearly 3000 cubic meters at the site can be collected through the management system and seep into the earth, to replenish the urban groundwater. A city is an integration of numerous communities. It is undoubtedly of great promotion value and demonstration significance to the rainwater and flood management of the city to build an effective and easy-to-implement system to effectively collect the rainwater and supplement the continuously declining groundwater of the city.

通过本项目雨水管理体系的构建，在雨季时，降落到屋顶和场地的雨水汇聚到场地中的雨水汇水带，最终进入雨水下渗区进行蓄渗。经过建设后第一个雨水季的运行，场地近3000立方的降雨，可以通过这个管理系统进行接近100%收集并下渗，回补城市地下水。城市是由无数社区构成的一个综合体，当我们在社区中可以构建一个高效、易实行的系统有效的对雨水进行收集，补充城市不断下降的地下水，这种方式对整个城市的雨洪管理无意具有巨大的推广价值和示范意义。

The practice of rainwater management is still at its infant stage in China. While drawing on appropriate technologies and experiences in Europe and America, full understanding and respect for the current situation in China is particularly important. Rainwater management is not an end in itself, and the best practice of sustainable design should begin with understanding clients' needs and their practical situation, designing unique rainwater management strategies and goals, thus creating more sustainable lifestyles and experiences for each and every one of them.

中国的城市雨水管理实践刚刚起步，在借鉴欧美相应技术和经验的的同时，特别需要对中国的现状有充分的理解和尊重。对我们而言，雨水管理不是目的，从客户的需求和实际情况出发，制定每个独特的雨水管理策略和目标，从而为客户创造更具可持续的生活方式和体验，这就是进行可持续设计的最佳途径。

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Case Study: New Google Office Building

案例分析：谷歌的新办公大楼

Overview
概述

Google is experiencing rapid growth of their engineering teams in Washington State, and has expanded their facilities to double the workforce in their Kirkland campus. Created in partnership with SRM Development, the campus expansion is focused on environmental stewardship and human well-being to achieve a high-performance building design.

DLR Group participated in both a shell and core design for this new build-to-suit office and a phased interior build out, all while exceeding Google's high sustainability goals, ultimately, targeting LEED Platinum certification. This project redevelops 5 acres of former brownfield site to accommodate an 180,000 SF office and a 600 vehicle parking garage.

The three key design goals were user experience, health, and environmental stewardship.

谷歌公司在华盛顿州的工程师团队正在迅速扩大，为此谷歌扩建了柯克兰园区的办公设施，以便容纳将近翻倍的员工人数。扩建项目由不动产开发公司SRM承建，重点强调建筑与环境的结合，以及以人为本的设计思想，以达到高性能建筑的标准。

DLR集团参与了这个谷歌定制的扩建工程外观与核心的设计，还参与了分阶段的内部装修。工程要在超过谷歌极高的可持续设计标准的同时，把获得LEED白金级认证作为努力的目标。扩建项目是对一块占地5英亩（约2万平方米）的棕地进行再开发，建成后的建筑将提供18万平方英尺（1.67万平方米）的办公空间，以及有600个停车位的停车场。

该项目的三个关键设计目标是，用户体验、健康福利，以及与环境的结合。

Design Impacts
设计的力量

Exterior walkways along each face of the building provide a space for employees to get outdoors. The walkways were designed to provide shading to minimize HVAC sizing and reduce the need for blinds which is takes away from the natural light and the view outside.

建筑外部每一面都配备了室外走廊，目的是让员工有感受户外的机会，同时走廊也可以带来阴凉，减小空调设备的规格，同时减少安装百叶帘的数量，因为百叶窗既会阻挡自然光，也会妨碍欣赏室外的风景。

DLR Group led this effort by enhancing the architectural design with a high performance envelope, optimizing the glazing percentage, shading to improve thermal and visual comfort. The envelope is complimented with integrated sun shading devices and four large skylights. Two of these skylights incorporate sun beamers with automated controls for targeted sunlight penetration. Indoor plants allow air to be filtered and the green roof provides a connection to nature, slow down of storm water and solar heat mitigation.

DLR集团设计的最大亮点是对建筑结构进行了优化。他们给建筑提供一个的性能卓越的维护结构，这个维护结构优化了外立面玻璃的比例和遮阳设计，以提高室内温度的舒适性，扩大视野范围。除了这个维护结构外，项目提供了一套整体式的遮阳装置以及四个大天窗。其中的两个天窗还配有带自动控制的阳光投影机，能够控制阳光透进室内的角度。室内植物也有助于过滤阳光，绿色屋顶连接了人与大自然，还能降低雨水的流速以及太阳光的热量。

A dedicated outside air system will provide the minimum ventilation and primary air flow for the zone heating and cooling system. Due to higher internal loads, a chilled beam system was selected to provide the heating and cooling requirements for the zones, allowing higher ceiling heights and better acoustics. The space is also served by a central plant with heat recovery. The 100% outside air improves the air quality in the space due to no mixing of return air; zone heating and cooling also provides improved thermal comfort. A rainwater catchment system reuses water for flushing and irrigation. The interior lighting design is optimized to provide high performing LED fixtures, layout, and sophisticated controls and dimming.

分区的冷热空调系统配有专门的室外空气处理系统，保证了室内基本的通风和空气流动。由于室内空调负载较大，设计师选用了冷梁空调系统为各区域提供供暖和冷气。由于采用了这样的空调系统，节省了天花板的空间，吊顶位置可以更高，并且使空间具有更好的声学效果。此外项目也通过中央机房进行热回收。由于不再使用混合的回风，100%通过外部空气进行的空气循环改善了室内的空气质量。同时分区的冷热系统提高了室温的舒适度。雨水排水收集系统可以循环利用雨水，用来冲洗和灌溉。设计师对室内照明也进行了优化，照明选用高性能的LED灯具，同时具有复杂的控制和调光功能，照明的布局也非常合理。

The floor plan of the campus was developed to provide pedestrian connections to the existing campus and encourage “casual collisions,” informal meetings and idea exchanges that occur in in-between places. The building floor plan was optimized to maximize the usability with regards to the tenant’s team sizes’ and team interactions. Features include exterior decks with views of Lake Washington and the Olympic mountains, bike paths, bike lockers and shower facility.

园区的布局考虑了与原有园区的连接问题，设计了与原有园区相通的步行道，鼓励在新旧园区的中间地带发生“不经意的邂逅”，非正式会面以及灵感的互动。考虑到谷歌的团队规模以及团队的互动需求，楼层布局提高了利用率。比如，站在室外平台上，可以把华盛顿湖和奥林匹克山尽收眼底，区内还有自行车道，自行车储存柜，以及沐浴设施等。

Key Sustainable Features
关键可持续设计亮点

Upgrades to the project to meet 2030 goals and LEED Platinum Goals. Energy savings compared to ASHRAE 90.1 2007.

项目的升级是为了达到2030目标，以及LEED白金级认证标准。能源节约标准比照美国采暖、制冷和空调工程师协会（ASHRAE）90.1–2007。

Envelope 维护结构	Leads to load reduction The building envelope exterior shading not only supports the high performance mechanical system by reducing cooling loads, but ensures panoramic views and maximizes daylight exposure. Optimized glazing percentage, shading to improve thermal and visual comfort. 旨在降低空调负载。 建筑外的遮阳走廊，不仅能够通过降低制冷负载帮助减轻高性能暖通系统的负担，而且还确保通透的视野，并最大程度引入自然光源。 优化了外立面玻璃的比例和遮阳设计，以提高室内温度的舒适性，扩大视野范围。
Energy 能源	$60-80K Annual Energy Savings 30%+ total energy reduction; 60kW photovoltaic array; Robust sub-metering system puts power in the Facility Manager’s hands with real-time performance monitoring and data collection 每年节约6–8万美元能源成本。 总节省能源30%以上，60千瓦时的光伏发电板阵，强大的用电分项计量系统，能够实时监控用电情况，收集数据，让后勤经理对能源消耗情况了如指掌。
HVAC 暖通空调	Chilled beams use 100% filtered outside air with zoned heating and cooling coils to meet diverse thermal requirements with minimal air mixing. Heat recovery at air side and central plant heating pump leverages high equipment loads. A dry cooler aids heat rejection in summer and a high efficiency condensing boiler reduces heating energy in winter. 55% HVAC Specific Energy Savings* 冷梁空调系统100%利用经过滤的外部空气和分区的冷热盘管满足不同的供暖需求，减少混合空气的使用。由于设备负载较高，产生的热能通过风侧和中心循环系统换热泵进行回收利用。在夏天，通过干式冷却器辅助散热，在冬天，通过高功率的冷凝式锅炉减少热能消耗。暖通空调节约了55%的能耗。
Lighting 照明	39% Lighting Specific Energy Savings due to efficient lighting design and sophisticated lighting controls 由于采用了高效率的照明设计和复杂的照明控制功能，照明比能消耗减少39%。
Water 水资源	200,000 gallon capacity rainwater catchment cistern provides 75% water use reduction. HVAC system eliminates the need for a cooling tower and hence reduced water consumption. 容量20万加仑的雨水蓄水箱减少了75%的用水量。同时，由于空调系统不需要冷却塔，也大减少了对水资源的需求。

Key Success Factors
成功的关键因素

Collaboration
精诚协作

A deep sense of collaboration was pivotal for the multiple stake holders who had vested interests with often contrary requirements. The owner was interested in pursuing the same systems as their existing facilities for ease of maintenance. The tenant had a list of project requirements that they wanted to achieve, including user experience, enhanced health and wellness and environmental stewardship. These desires were met by DLR Group by presenting options for the multiple system types and working together with the stake holders to walk them through the benefits of each system. The systems design was judged by the performance and impact on user experience and health.

Tenant Improvement work was allowed to start while the Core & Shell was being completed. This was especially helpful for HVAC integration since the tenant equipment ties into the core and shell central plant.

在外观和核心工程尚未完工之时，谷歌的改造工程就已经开始了。这对于空调系统的整合非常有帮助，因为谷歌的设备与内外循环系统紧密关联。

由于项目涉及的利益相关方比较多，而众多利益相关者的需求往往是相反的，因此进行深度合作是成功的关键。项目承建方关心的是继续延用现有设备，这样比较易于维护，而定制该项目的未来用户——谷歌则列出了长长的项目需求，包括用户体验、提高健康福利，以及与环境的结合的目标。DLR通过展现多种系统类型，与利益相关者共同讨论利弊，以作出了选择，最终满足了用户的需求。最后系统的设计方案根据其性能，以及对用户体验和健康福利的影响来决定。

High Performance Building
高性能的建筑

The high energy consumption and internal load needs for this type of building was a central concern during the design phase. The design used innovative systems to leverage the facility type and loads in order to keep its energy impact low and maximize savings. Design parameters were focused on the utilization improvement, and will likely become a standard design strategy for this type of building

在设计阶段，此类建筑较高的能源消耗以及内部负载需求一直是一个核心问题。设计方案采用了创新的系统，利用所采用设备的类型和负载情况，把能源消耗率降到最低，最大限度地节约了能源。设计参数主要关注利用率的提高，很有可能成为此类建筑的标准设计策略。

Key Performance Indicators
关键绩效指标

KPIs were set for indoor air quality, thermal comfort, acoustics, visual comfort and biophilia.

针对室内空气质量、温度舒适度、声学效果、视野的舒适度，以及人与自然的和谐分别制定了关键绩效指标。

Community Impact
对社区的贡献

The tenant's impact grew within the local community thanks to the forward thinking of the developer. This project redeveloped a brownfield site and provides a huge benefit to the surrounding areas with its campus facilities and eco-park, available for use by the public. A school sports field and a transit Right of Way were improved due to this project, to include community basketball, volleyball, cross-fit, green space, and a playground. Another positive impact is the redevelopment of the Kirkland bike-path. The path was initially used for recreation, and has now been reborn as a "spine" that will be used to connect businesses in the area. Now the "backside" of the commercial buildings that line the path have become a front door.

该物业的用户——谷歌在当地社区内的影响日益增长，多亏了开发商的前卫思维。这个项目是对棕地进行的再开发，这也给周围社区带来巨大的益处，其园区的设施和生态公园都可供周围的民众使用。因为这个项目的建设，还对一个学校的运动场，以及一条路的交通进行了改造，给社区提供了篮球场、排球场、体能锻炼场、绿地，还有一个儿童游戏场。项目给社区带来的另一个贡献是重修了柯克兰的自行车道。这条路原本是用来供大家休闲的，现在脱胎换骨成了一条主干道，把该地区的企业都连接了起来。原本这条路两边的商务楼宇是把面向这条路的一侧看作是后院，现在都把前门开到这条路上来了。

Stormwater and Flood Risk Management in Hong Kong
An Engineering Innovation
香港雨洪风险控制：工程的创新

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A. Description of Hong Kong Rainstorm
香港的降水情况概述

Due to its geographic location, Hong Kong experiences heavy, yet uneven distribution of rainfall every year. The rainfall in Hong Kong averages 2200 mm annually, and more than 80% of this falls during the period May to September. Intensities can be high, with 50 mm per hour and 200 mm in 24 hours being not uncommon. Flooding in low-lying areas, in particular the Northern New Territories, used to be frequent. Flooding can cause huge disruption to transport, communications, daily life and commercial activities, inflict fatalities and damage properties and the economy.

In the past, the provision of drainage infrastructure has been fragmented and was provided basically to meet the need of individual new towns or parcels of land development. This approach has drawbacks of being unable to formulate a comprehensive and long-term solution to the drainage problems.

Since the establishment of the Drainage Services Department (DSD) in 1989, the need to put drainage and flood control on a rational and planned basis was recognized. Over the years, DSD has commissioned consultants to develop a comprehensive flood prevention strategy for the whole territory. AECOM has played a significant role in assisting DSD on planning, design and implementation of the drainage infrastructure over the years.

由于地理位置特殊，香港每年的降水量很大，且分布不均。香港每年的降雨量平均在2200毫米左右，其中超过80%的降雨量又集中在每年的5月到9月之间。同时，降雨强度也很大，每小时降雨量50毫米，24小时降雨200毫米的情况并不少见。低洼地区尤其是新界北部出现洪水泛滥的情况一直比较频繁。洪水可能导致严重的交通、通讯中断，影响日常生活和商业活动，造成生命和财产损失，影响经济发展。

过去的排水设施一直是相互孤立分隔的，基本上只能满足个别新城和成块土地开发的需要。这样的排水设施建设无法从全局角度考虑和解决排水问题，也不是长久之计。

自1989年香港设立了渠务署（DSD）以来，排水和防洪控制问题逐渐受到重视，排水防洪被纳入到了政府的规划中。DSD几年来已委托众多顾问公司为香港全区域制定全面的防洪策略。AECOM公司一直在帮助DSD进行排水基础设施的规划、设计和施工。

B. Drainage master plans and drainage improvement works
排水总体规划和排水改善工程

The Territorial Land Drainage and Flood Control Strategy Study (TEL I) was the first comprehensive stormwater and flood risk management plan in Hong Kong. It paved the way and established an overall flood prevention strategy in 1990. The strategy can be grouped into five main categories:

- New flood prevention standards
- Long term structural measures
- Short term improvement measures
- Land use management and legislative measures
- Planned preventive approach to maintenance

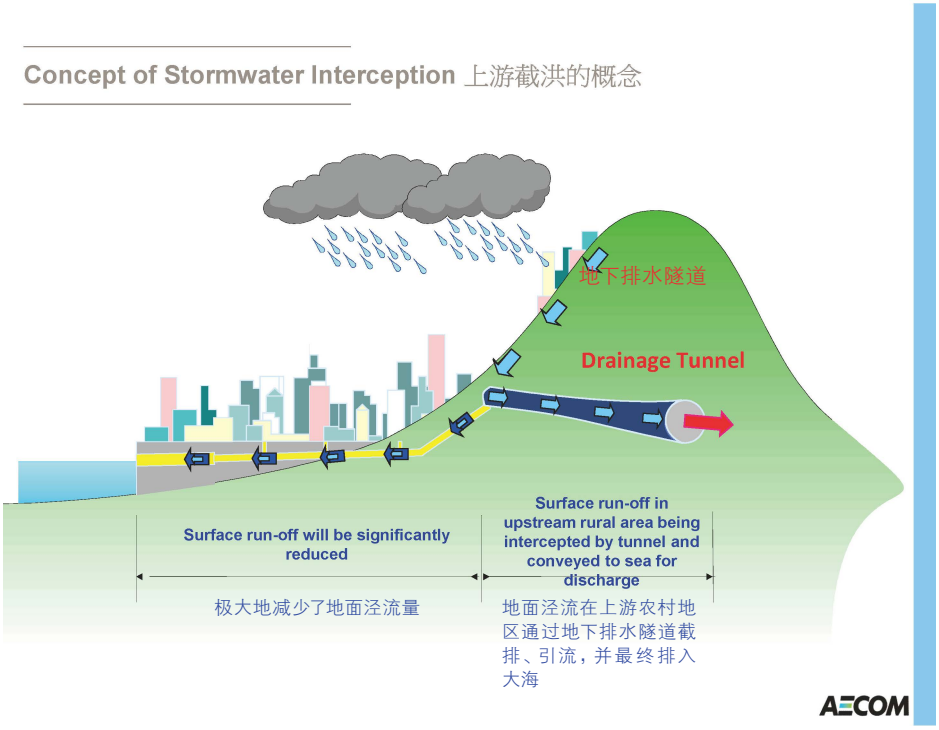
国土排水和防洪战略研究（TEL I）是香港第一部全面雨洪控制规划。这项规划为1990年制定的总体防洪战略奠定了基础。该战略可分为五个大类：

- 新的防洪标准
- 长期结构性调整措施
- 短期速效改进措施
- 土地利用管理与立法措施
- 计划预防维护措施

With formulation of the overall flood control strategy and the implementation of the recommended primary drainage networks in the Northern and Northwest New Territories, DSD has extended the scope of study. In 1996, DSD employed consultants to carry out seven Stormwater Drainage Master Plan Studies (DMP Studies) to review the performance and condition of the existing drainage systems for most flood prone areas over Hong Kong. The objective of the studies is to identify inadequacies in the drainage system and recommend improvement measures. Another important role is to develop a computerised system to enhance the efficiency of drainage asset management by means of a territory-wide digital database of the drainage network. Since then, there have been several rounds of reviews and updates of the DMP to incorporate the latest changes and developments in the catchments.

在防洪总体战略的指导下，随着所建议的新界北部以及西北部主要排水工程的施工，DSD又扩大了调查研究的范围。1996年，DSD再次邀请顾问公司进行了7次暴雨排水总体规划研究（DMP研究），对香港易发洪水地区原有的排水系统现状进行了调研。DMP研究的目标是寻找原有排水系统的缺陷，同时找到改进措施。DSD采取的另一

Concept of Stormwater Interception 上游截洪的概念



项重要措施是利用计算机系统提高排水设施管理的效率，为全香港的排水系统建立了数字化的数据库。此后，又对DMP进行了数轮审核和更新，以反映流域内最新变化和发展情况。

C. Innovative Technology
技术创新

Among the numerous drainage improvement measures, one of the innovative solutions worth mentioning is the stormwater drainage tunnel. AECOM is the consultant responsible for the design and implementation of the Lai Chi Kok Drainage Tunnel which has adopted an interception approach with six intakes constructed along Northern side of Ching Cheung Road to intercept stormwater flow. The intercepted flow is then diverted to the stilling basin via the branch tunnel and then further discharge to the harbour via the main tunnel. The drainage tunnel provides flood relief for the low-lying urban areas at Lai Chi Kok, Sham Shui Po, and Cheung Sha Wan areas.

The traditional approach requires enlarging the existing drainage system within urban area while the tunnel interception approach is an innovative flood relief measure. The construction work sites are located in rural areas such that extensive road openings can be avoided and minimize the disturbances to the public, traffic, and commercial activities and at the same time achieving the flood relief purpose.

在无数排水改进措施中，最值得一提的创新方案是地下雨水排放隧道。AECOM科技负责的是荔枝角排水隧道的设计和施工。荔枝角排水隧道采用的是雨水截排的方法——沿呈祥道北面设置了6个进水口，截取雨水水流。被截水流随后通过支隧道被导流入消速池，又进一步通过主隧道导排至集水港。排水隧道缓解了荔枝角、深水埗、长沙湾等低洼地区的积水问题。

传统的排水方法需要扩建城区原有的排水系统，而创新的隧道截排水泄洪法，其施工现场位于农村地区，避免了大面积的道路掘挖，极大减少了对公众、交通以及商业活动的影响，与此同时又实现了泄洪的目的。

D.Integrating Engineering into Nature
工程与自然环境的融合

In modern designs, it is important to harmonize engineering works with the surrounding and to preserve the natural habitat, AECOM have developed various environmentally friendly designs, including:

- Grasscreting and extensive vegetation along channel embankment to enhance aesthetic value and diversity of micro-habitats;
- Using gabions and geo-fabric reinforced grass lining to stabilize side slopes;
- Utilizing unlined channel beds to enable colonization of flora and fauna;
- Creating shallow ponds as aquatic planting bays to allow freshwater fish, amphibians and water birds to thrive;
- Creating wetland habitats and reed beds to flourish diversified wildlife;
- Providing flow deflector, in-stream refugia and fish ladder to enhance the habitat complexity and thus ecology of the river

如何保持工程项目与周围环境的平衡与和谐，保护天然动植物生存环境是现代设计面临的重要课题。AECOM科技为此进行多种多样的环保设计，例如：

- 在渠堤上配置混凝土草格或广泛栽种植被以提高美观度，同时丰富了动植物生存的微环境。
- 利用石笼网，以及铺设土工织物在沟渠边坡植草衬砌，稳固边坡。
- 使用无衬层的渠床，有利于动植物在渠床上安

家落户。
• 修建浅水塘，创造水生植物的生长环境，吸引淡水鱼类、两栖动物和水鸟在此繁衍生息。
• 创造湿地生态环境和芦苇河滩，促进生物的多样化。
• 提供导流板、在水流中设置庇护所，修建鱼梯（便于鱼类游向上游或游过水坝而建造的一系列梯层水池）以增加生物生存环境的多样性，改善河流的生态环境。

E. Asset Inventory Management System (AIMS)
资产库存管理系统（AIMS）

A full inventory of the drainage asset is important for keeping the existing information and planning for future works. Details of existing and planned land use, and hydrological and hydraulic data are essential. The DSD has developed a drainage asset inventory management system (AIMS) which provides a framework of the hydraulic behaviour of the drainage basins and establishes a baseline against which the impacts of development on the hydraulic behaviour of the basin can be assessed.

Apart from an analytical tool, the AIMS can be used as a management tool to determine the service level (in terms of hydraulic and structure performance) and criticality (in terms of the risk of causing disturbance and damage to the public) of the drainage assets. Management plans comprising courses of action, operation plans and maintenance schedules can be derived from the AIMS.

排水系统需要具备完整的资产库存，无论是对于保存现有信息，还是对未来工程的规划来说，这都是至关重要的。现有和未来规划的土地使用的详细情况，以及水文、水利数据也都是必不可少的。DSD已经开发了一个排水系统资产库存管理系统（AIMS）。这个系统提供了测定排水池水力性能的框架，同时还设定了基准线。通过对比基准线，可以测量城市开发对排水池水力性能产生的影响。
AIMS不仅是一个分析性工具，也可以（通过水力性能数据和结构性表现指标）成为衡量服务水平，以及排水资产临界状况（通过对公众造成的影响风险程度和破坏程度）的管理工具。此外，还可以利用AIMS制定包括行动方针，运营计划以及维护日程表的管理规划。

Summary Remarks
结束语

Hong Kong is constantly under the threats and damages of flooding which can be attributed to a number of factors, namely topography, geology, rainfall, land use and population.

Over the decades, AECOM has the honour to assist DSD and other branches of the Government to plan, develop and implement various drainage structural and non-structural measures to protect the people and their properties. We are proud to say that most parts of Hong Kong are now safely protected against the threats and damages of serious flooding. Our experience of success is due to the following factors:

• A holistic total catchment approach, from broad-brush to details, with appropriate structural and non-structural measures

• Thinking out of the box. Innovative methods such as flow diversion tunnels have been employed to ease off disturbances to traffic or conflicts with utilities installed underground.

• Harmonizing the engineering design with environment. Provide aesthetically pleasing design, protect the environment and natural habitat while achieving the flood protection objective.

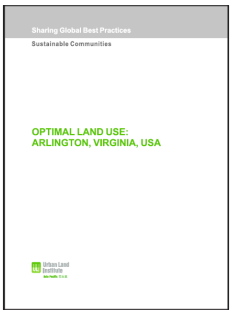
• Keeping asset inventory for better management decision and providing accurate and up-to-date record of drainage and other assets.

香港一直以来遭受洪水破坏的威胁，其中有地形、地质、降雨量、土地利用以及人口等因素。
AECOM科技很荣幸在过去的几十年中能够协助DSD以及其它政府部门规划、开发和实施各种排水设施的结构性和非结构性措施，保护了人民和财产的安全。现在，我们可以自豪地说，香港的绝大部分地区已经得到了安全保障，能够免受严重洪水的威胁和损害。我们的成功因素可以总结为以下几点：

• 全局性的排水方案，既有总体考虑，也有细节设计，同时采取了结构性和非结构性措施相结合的方法
• 跳出思维定势，运用创新的方法比如应用导流隧道减少了对交通造成的影响，也减少了与地下公用设施的冲突。
• 注意工程设计与周围环境的和谐，设计中兼顾实用和美观，在保护环境和生物的自然生存条件的同时实现了泄洪的目标。
• 保留资产库存，为更好的管理决策提供依据，同时提供排水设施及其它资产的准确数据记录，并保证数据的及时更新。

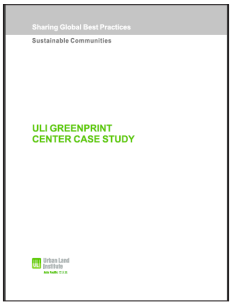
Other “Sharing Global Best Practices – Sustainable Communities” Reports

其他 “分享全球最佳实践——可持续发展社区” 报告



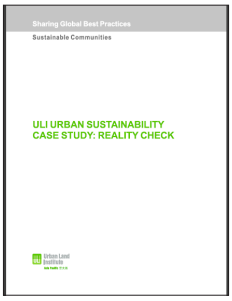
1. Optimal Land Use: Arlington, Virginia, USA
优化用地：美国弗吉尼亚州阿灵顿县

English Version　　中文



2. ULI Greenprint Center Case Study
城市土地学会绿色印迹中心案例研究

English Version　　中文



3. ULI Urban Sustainability Case Study: Reality Check
城市土地学会可持续发展案例研究：现状核实

English Version　　中文

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